

### REMARKS

An Amendment After Final Rejection was previously filed on April 3, 2003, but, as Applicants were informed in the Advisory Action, the Amendment was not entered. The Advisory Action stated that “the new limitation ‘determining, by a management program, if a user application is executing on the partitioned network cluster’” would require further consideration or a new search. The amendment of clarifying that the application program was a user application did not raise those concerns.

In response to the Advisory Action and the Final Office Action, certain claims have been amended. Entry of these amendments will advance the application to issue and narrow the issues for appeal. For the reasons described below, it is believed that all claims are in condition for allowance.

Claims 1-20 are pending in the application. All claims stand rejected. Claims 1-2, 5-6, 12-14, and 17-18 have been rejected under 35 U.S.C. § 102(e). Claims 3-4, 7-8, 15-16 and 19-20 have been rejected under 35 U.S.C. § 103(a). In response, certain claims have been amended to more distinctly claim the invention.

#### Regarding Claim Amendments

Claims 1, 3-5, 10-13, 15-17, 19 and 20 are amended to further clarify that the Applicants’ claimed “application program executing on the network cluster” refers to a “user application program executing on the network cluster.” When the ordinary meaning of “application program” is interpreted in the context of the claims in light of the specification, it is believed that one of ordinary skill would interpret “application program” to mean “*user* application program.” That is, when the claimed application program interpreted in the context of the invention, it refers to application programs that are directed to application level software architecture, such as a database application, and thus, the claimed application program is **not** directed to system level software architecture, such as any cluster system software or operating system software. Therefore, the claims are amended to recite “*user* application programs” to specify that this limitation is not directed to system level software architecture. Support for these amendments can be found at least in Claims 1, 3, 7, 10 and 12 as originally filed, and in the Specification at

least at pg. 2, ll. 15 to 19, pg. 3, ll. 18 to 20, pg. 17, ll. 8 to 15, and Fig. 2 (distributed application 36). Thus, no new matter is being introduced.

Entry of the amendments should not necessitate a new search or place additional burdens on the office. In fact, the distinction between an application program and cluster management software was explicitly described in the Applicant's previous Amendment A (filed October 17, 2002). As such, the claims have been amended to recite how they should have been interpreted. Acceptance and entry of the amendments are respectfully requested.

#### Regarding Rejections

For the convenience of the Examiner, the Applicants will first address the rejections of independent Claims 1, 7, 12, 13, 19 and 20, and then, in particular, the rejections of independent Claims 19 and 20.

##### A. Regarding Rejection of the Independent Claims

As recited in Claims 1, 7, 12, 13, 19 and 20, the claimed invention relates to a figure of merit which indicates a value for a member node of a partitioned network cluster to continue operating. A management program queries (requests) a user application program executing on the network cluster for the figure of merit. The user application program determines the figure of merit. The figure of merit is then returned from the user application program to the management program.

By having the management program query a user application program, the user application program is afforded an opportunity to provide a vote as to the value of the node upon which it is executing. Thus, the claimed *querying, by a management program, a user application program for the figure of merit* is not taught or suggested by the prior art, as explained in more detail below. Accordingly, it is respectfully submitted that these claims are allowable.

In the present Office Action, independent Claims 1, 12 and 13 were rejected under 35 U.S.C. § 102(e) based on U.S. Patent No. 6,192,401 to Modiri. In a separate rejection, independent claims 1, 7, 12 and 13 were rejected under 35 U.S.C. § 103(a) as unpatentable over

Modiri in view of U.S. Patent No. 5,999,712 to Moiin and/or U.S. Patent No. 5,325,526 to Cameron. In these rejections, the Office stated that the Applicants' claimed "application program" corresponded with the software discussed in Modiri and Moiin. For example, with respect to Modiri, on pages 2 to 3 of the Office Action, the Examiner states:

As to querying an application program, Modiri teaches that the method of determining a figure of merit may be implemented in software (column 2, lines 60-62). Modiri teaches that the cluster management software (software layer 250) and an application program (software modules in layer 220) determine a node's value (the software modules in layers 220 and 250 are responsible for determining the membership in the cluster; column 6, lines 30-35) and the cluster framework 220 includes modules such as the cluster membership and quorum and reconfiguration 224 that provides reconfiguration decision making (column 4, lines 50 - 67).

Further, with respect to Moiin, the Examiner states that "Moiin teaches querying (send RECONF\_msg to each node) and application (function membership\_prop())."<sup>1</sup>

Although the Examiner correctly notes that Modiri and Moiin may be implemented in software, it is respectfully submitted that the software implementations discussed in these references correspond to cluster system level software and not to the Applicants' claimed user *application* programs, and, therefore, these references do not disclose the limitations and advantages of the claimed invention.

In conventional systems that resolve cluster partitions, such as those of Modiri and Moiin, cluster software determined a node's value independent of any vote from user applications programs executing on the cluster partition.<sup>2</sup> As now claimed, however, the invention resolves a cluster partition by modifying the conventional cluster software to enable it to query each user application program executing on the network cluster for a vote on their node's value to the cluster. In this way criteria, such as a number of users and priority of the application can be evaluated when selecting the surviving cluster partition.<sup>3</sup> None of the cited references recognize or discuss the importance of enabling "a *user application*, operating on the cluster, to provide

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<sup>1</sup> Final Office Action, pg. 7.

<sup>2</sup> See Specification, pg. 3, ll. 12 to 13.

<sup>3</sup> Specification, pg. 3, ll. 13 to 15.

input to the cluster manager. . . regarding the use of the node's resources by the applications actually executing on the nodes.”<sup>4</sup>

Modiri, for instance, teaches to use cluster software (cluster management software 220 and cluster framework software 250) to determine a node's value by assigning values to each node, and like the cluster software prior art, these values are determined *independent* of any determining by user application programs executing on the nodes.<sup>5</sup> There is no need in Modiri to involve user application programs in the determination of a node's value because Modiri's invention relates to a different concept that solves different problems with respect to resolving partitioned clusters. In fact, with respect to determining the node's value, Modiri determines a node's value with cluster software regardless of the presence of user application programs. Thus, Modiri does not discuss the advantages or limitations of the claimed invention.

Similarly, the Moiin reference teaches that each node uses its cluster membership monitor to vote on cluster membership and to handle any communication and device failures. Notably, Moiin does nothing to enable *user application* programs to vote on the value of the nodes they are executing upon. Thus, Moiin does not discuss the advantages or limitations of the claimed invention.

Moreover, similar to the Applicants, the Modiri, Moiin and Cameron patents each teach to distinguish between system level software and application programs executing on the network. For example, the Modiri patent discusses that cluster management software and applications have distinctly different meanings and distinctly different roles in a distributed system.<sup>6</sup> Likewise, in Moiin, “cluster membership monitor” (CMM) software and application programs

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<sup>4</sup> See Specification, pg. 3, ll. 18 to 21.

<sup>5</sup> See Modiri, col. 2, ll. 25 to 40, and Fig. 2.

<sup>6</sup> See Modiri, col. 2, ll. 26 to 27 (describing “cluster management software” which assigns weighting values to nodes), and col. 5, ll. 8 to 33 (describing *applications* (such as “generic applications,” “data service applications,” and “databases” - which are monitored by the cluster management software for failures/faults)).

are discussed in distinctly different contexts.<sup>7</sup> Also, Cameron specifically distinguishes between applications and system software. For example, Cameron states that:

*Application programs* (hereinafter applications) comprise processing logic for performing a specific function for a computer user or for the manipulation of a specific type of data. *Applications* are typically **distinguished** from operating system software of which a task scheduler is a part.<sup>8</sup>

Thus, Modiri, Moiin and Cameron each recognize that there are distinct differences between applications running on the nodes and system level software (such as managers, monitors and schedulers), and therefore, it is respectfully submitted that one of ordinary skill would understand that the Applicants' claimed *user application program* is directed to a different level of software architecture and does not correspond to the cluster or system level software discussed in Modiri, Moiin, or Cameron, which does not correspond to the management software claimed in the Applicants' invention.

Furthermore, Modiri teaches away from the claimed invention because all of the examples of selection factors discussed in Modiri aim to "increase availability and performance" by favoring nodes that have the most processing power and physical memory because these nodes are less susceptible to failure.<sup>9</sup> As such, Modiri teaches to favor nodes that have the most *available* hardware resources to contribute to the cluster, and this is a different concept than the Applicants' claimed invention, which determines a nodes value based on the user applications programs which are actually *consuming* the node's resources. As such, according to the teachings of Modiri, nodes whose resources are consumed by executing user application programs would **not** be favored because these nodes would not be the "fastest," as they would likely have less available resources. Thus, by only mentioning factors that provide preference to

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<sup>7</sup> See Moiin, col. 2, ll. 28 to 31 (describing that the "CMM is responsible for membership, quorum and failure") and col. 2, ll. 53-55 (describing that "the CMM does not guarantee. . . that the *applications* are present on any given node").

<sup>8</sup> Cameron, col. 1, ll. 20 to 25 (Emphasis added).

<sup>9</sup> See Modiri, col. 2, ll. 11 to 13 (selecting nodes that can "freely communicate;" col. 2, ll. 35-40: favoring the "fastest nodes"); col. 2, ll. 44-45 (selecting nodes based on "processing power. . . amount of physical memory;" col. 7, ll. 29 (selecting nodes based on "response time to a request"); and col. 9, ll. 10 (selecting nodes that are "functionally operational (i.e. 'healthy')").

the fastest nodes, with the most available resources, Modiri teaches away from the Applicants' claimed invention.

Likewise, Moiin teaches away from the Applicants' claimed invention because the criteria used by the cluster membership monitor (CMM) in Moiin to determine members for a new cluster is based on hardware or operating system performance in that, namely, it is based on the connectivity information (interconnectivity of all the nodes that are directly or indirectly connected).<sup>10</sup> In addition, according to Moiin, "it is also important to note that the CMM does not guarantee the health of the overall system or that the *applications* are present on any given node. . . [t]he only guarantee is that the system's hardware is up and running and the operating system is present and functioning."<sup>11</sup> Thus, Moiin teaches that the presence of applications on a node is **not** essential and therefore, Moiin teaches away from the Applicants' claimed invention which requires that a user application program be present to be queried and to determine the value of its node to the cluster.

Furthermore, neither of the references discuss *returning by the user application program the figure of merit to the cluster system manager*. In Modiri, for example, the process of determining a node's value stays within the control of the cluster software. Therefore, Modiri is silent as to any returning of a node's value from applications to the cluster software because the applications do not partake in determining a node's value in the first place. Moiin also does not discuss that an application program returns a node's value to the cluster software because, for example, according to Moiin there is no guarantee that applications are even present.<sup>12</sup>

As none of the Modiri, Moiin and Cameron patents, taken separately or in combination, teach or suggest the claimed "querying, by the cluster management software, a user application program for the figure of merit" and "returning, from the user application program, the figure of merit to the cluster management software" of Applicants' Claims 1, 7, 12 and 13 it is believed these claims and their dependents are allowable.

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<sup>10</sup> See Moiin, Abstract, col. 4, ll. 24 to 40.

<sup>11</sup> Moiin, col. 2, ll. 53 to 55. (Emphasis added).

<sup>12</sup> See Moiin, col. 2, ll. 53 to 55.

B. Regarding Rejection of Independent Claims 19 and 20

With respect to the rejections of Claims 19 and 20 based on Modiri and/or Moiin in view of Cameron, the Applicants respectfully submit that the combination of these references does not make the invention obvious.

Among other things, Claims 19 and 20 require that a management program to query a user application program for the value of the node upon which it is executing (figure of merit). The Application program assesses merit criteria for determining its execution priority, and determining its nodes value by determining a number of users executing it from its node.

The Applicants respectfully submit that Cameron discloses a typically operating system task scheduler that has been modified to concurrently manage the resources of multiple partitions. Any teachings relating to “priority” in Cameron relate to establishing priority resources allocations for partitions. It is respectfully submitted that there is no motivation in Cameron to combine this “priority”-concept to the Modiri and/or Moiin, and furthermore this “priority” concept is not the same as the Applicants’ claimed assessing merit criteria for a node to continue operating by determining an execution priority of the user application program, as set forth in Claims 19 and 20.

The Examiner states on page 6 of the Office Action that, “Modiri as modified by Moiin does not disclose using execution priority of an application to determine figure of merit. However, Cameron teaches (col. 11, ll. 1-6) that figure of merit (partition priority) can be associated with application priority.” It is respectfully submitted that Cameron appears to be nonanalogous art because it relates to a scheduler and allocator that perform resource allocation and partitioning, which includes creating “partition priorities.” Nevertheless, if this scheduler and “partition priorities” of Cameron is analogous art, then Applicants respectfully submit that the teaching of “partition priorities” in Cameron are not compatible with the Modiri and Moiin inventions and therefore cannot render the claimed invention obvious.

The Modiri and Moiin patents, for instance, teach to avoid partitioning whereas Cameron’s invention is directed to a scheduler and allocator which are “creating new partitions”

that have priorities associated with applications.<sup>13</sup> That is, it is an “object” of the Cameron’s invention to “provide a multicomputer task scheduler. . . in which a node may be assigned to one or more *partitions* at a time. . . wherein *scheduling priorities of applications* and sub-partitions may be *acquired by the partitions* which contain them. . .”<sup>14</sup> In comparison, for example, the Moiin patent seeks to resolve cluster partitions by providing a “generalized algorithm that deals with the issue of a partitioned network.”<sup>15</sup> Further, according to Modiri, “[t]he *split-brain condition* leads to data and file corruption,” col. 2, ll. 5 to 16, and “[b]asing cluster membership decisions upon weighting factors . . . may advantageously increase availability and performance by favoring the most valued (fastest, etc.) nodes. . . to *prevent split-brain* configurations,” col. 2, ll. 35 to 40.

Thus, Cameron seeks to create and enable partitions whereas Modiri and Moiin seek to eliminate partitions (split-brain conditions and the like). In view of Cameron’s teachings to create partitions and Modiri and Moiin’s teachings to eliminate them by voting on or selecting surviving partitions, it is submitted that the combination of the teachings in Cameron with Modiri and Moiin would be inoperative. That is, the partition creation teachings of Cameron frustrate the purpose of Modiri and Moiin.

As none of the prior art teaches or suggest Claim 19 and 20, it is believed that these claims are allowable.

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<sup>13</sup> See Cameron, col. 3, ll. 17 to 20, and Abstract.

<sup>14</sup> See Cameron, col. 3, ll. 62 to col. 4, ll. 1.

<sup>15</sup> See Moiin, col. 1, ll. 57 to 60.



CONCLUSION

In view of the above amendments and remarks, it is believed that all claims are in condition for allowance, and it is respectfully requested that the application be passed to issue. If the Examiner feels that a telephone conference would expedite prosecution of this case, the Examiner is invited to call the undersigned attorney at (978) 341-0036.

Respectfully submitted,

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Dated:

*April 30, 2003*

MARKED UP VERSION OF AMENDMENTS

Specification Amendments Under 37 C.F.R. § 1.121(b)(1)(iii)

*Please replace the title with the following:*

Providing Figure of Merit Vote from A User Application Executing On A Partitioned Cluster

Claim Amendments Under 37 C.F.R. § 1.121(c)(1)(ii)

1. (Amended) A method for providing a figure of merit indicating a value for a member node of a partitioned network cluster to continue operating, the method comprising:
  - querying, by a management program, a[n] user application program executing on the partitioned network cluster for the figure of merit;
  - determining, by the user application program, the figure of merit; and
  - returning the figure of merit from the user application program to the management program.
3. (Amended) The method of Claim 2 wherein assessing merit criteria includes:
  - determining the number of users executing the user application program from the member node.
4. (Amended) The method of Claim 2 wherein assessing merit criteria includes:
  - determining an execution priority of the user application program.
5. (Amended) The method of Claim 1 wherein querying the user application program includes:
  - providing a proposed figure of merit.
7. (Amended) A method for resolving a partitioned computer network cluster including multiple cluster partitions, the method comprising:

evaluating a partition figure of merit for each cluster partition including:

requesting, from a[n] user application program executing on the cluster partition, a node figure of merit, the figure of merit indicating a value to the user application program for a member node on which the application is executing, to continue operation;

providing, from the user application program, the requested node figure of

merit; and

evaluating the provided node figure of merit to determine [to] the partition

figure of merit;

selecting, in response to the partition figure of merit, a cluster partition to

operate as the network cluster; and

halting operation of the remaining cluster partitions.

8. (Amended) The method of Claim [1] 7 wherein requesting a node figure of merit further includes:

providing, from a cluster manager executing on the member node, a proposed node figure of merit.

10. (Amended) The method of Claim 9 wherein assessing merit criteria includes:

determining a number of users executing the user application program from the member node.

11. (Amended) The method of Claim 9 wherein assessing merit criteria includes:

determining an execution priority of the user application program.

12. (Amended) A computer program product for providing a figure of merit indicating a value for a member node of a partitioned network cluster to continue operating, the computer program product comprising a computer usable medium having computer readable code thereon, including program code which:

queries a[n] user application program executing on the partitioned network cluster for the figure of merit.

13. (Amended) A system for providing a figure of merit indicating a value for a member node of a partitioned network cluster to continue operating, the system comprising:
  - a means for querying, by the management program, a[n] user application program executing on the partitioned network cluster for the figure of merit;
  - a means for determining, by the user application program, the figure of merit; and
  - a means for returning the figure of merit from the user application program to the management program.
15. (Amended) The system of Claim 14 wherein a means for assessing merit criteria includes:
  - a means for determining a number of users executing the user application program from the member node.
16. (Amended) The system of Claim 14 wherein a means for assessing merit criteria includes:
  - a means for determining an execution priority of the user application program.
17. (Amended) The system of Claim 13 wherein a means for querying the user application program includes:
  - a means for providing a proposed figure of merit.
19. (Amended) A method for providing a figure of merit indicating a value for a member node of a partitioned network cluster to continue operating, the method comprising:
  - providing a proposed figure of merit from a management program to a[n] user application program executing on the partitioned network cluster;
  - querying, by the management program, the user application program [executing on the partitioned network cluster] for the figure of merit;
  - assessing, by the user application program, merit criteria for the figure of merit, wherein assessing merit criteria including:
    - determining a number of users executing the user application program from the member node; and

- determining an execution priority of the user application program;
- determining an alternate figure of merit derived by assessing the merit criteria;
- selecting, by the user application program, between the proposed figure of merit and the alternate figure of merit; and
- returning the figure of merit from the user application program to the management program.

20. (Amended) A method for resolving a partitioned computer network cluster including multiple cluster partitions, the method comprising:

- evaluating a partition figure of merit for each cluster partition including:
  - providing, from a cluster manager executing on the member node, a proposed node figure of merit to a[n] user application program executing on the cluster partition;
  - requesting, from the user application program, a node figure of merit, indicating a value to the user application program for [a] the member node, on which the application is executing, to continue operation;
  - assessing, by the user application program, merit criteria for the member node, wherein assessing merit criteria including:
    - determining a number of users executing the user application program from the member node; and
    - determining an execution priority of the user application program;
  - determining, by the user application program, an alternate node figure of merit derived by assessing the merit criteria for the member node;
  - selecting between the proposed node figure of merit and the alternate node figure of merit;
  - providing, from the user application program, the requested node figure of merit; and
  - evaluating the provided node figure of merit to determine the partition figure of merit;
  - selecting, in response to the partition figure of merit, a cluster partition to operate as the network cluster; and
  - halting operation of the remaining cluster partitions.